REMARKS

As part of the various grounds for rejecting the memory system claims under 35 U.S.C. §103(a), the Office Action of January 22, 2003 states that the limitations of a "programming means" or "programming circuit" in each of the independent claims 13, 19, 23 and 34 do not provide a structure that can distinguish the cited prior art but rather only recite an intended use of the structure. Reconsideration of this basis of interpreting the claims is requested, in light of the claim amendments being made and these remarks.

This limitation is being amended in claim 19, for example, to read as follows:

> a programming circuit including a source of voltages connectable to <u>at least</u> the ~~source and~~ drain regions and ~~to at least~~ <u>the</u> first and second gates of addressed cells <u>with magnitudes that</u> ~~to~~ cause electrons to be transferred from the substrate into said at least first and second storage elements by channel hot-electron injection or source-side injection to a storage level according to data being programmed,

This limitation is submitted to properly define a "programming circuit" as a structural feature of the memory system that cannot be ignored. A source of voltages is defined to bring about a particular programming result. This functional language defines characteristics of the programming circuit source of voltages.

More specifically, a circuit is defined in the claims that provides voltages with magnitudes that bring about one of two specified programming mechanisms defined in the Background of the present application (page 2, lines 16 – 32) with reference to a portion of an IEEE Press book on non-volatile memories by Brown and Brewer, a copy of which was submitted with an IDS and made of record. The "source of voltages" of the claimed "programming circuit" is defined in terms of its function of causing programming according to one of these two programming mechanisms, which can be the basis of a patentable distinction. If the cited prior art does not disclose a circuit that applies programming voltages in the same manner as claimed, then the limitation imparts novelty to the claim.

Indeed, this limitation defines an important difference over the cited patent reference of Reisinger (patent no. 6,137,718), which describes a voltage used to bring

about programming by Fowler-Nordheim tunneling (col. 2, ln. 23; col. 3, lns. 6-7, 60 & 61), a programming mechanism excluded from the claims. Voltages that cause programming by the claimed channel hot-electron injection or source-side injection have not been found to be disclosed in Reisinger. All that is described in this regard by Reisinger is that voltage levels "between 11.5 volts and 15.5 volts" (col. 6, lns. 49-51), or "between +10 volts and +14 volts" (col. 7, lns. 51-53) are applied to the gate electrode.

Without applying an appropriate relative voltage to the drain of the memory cell, programming cannot take place by the claimed channel hot-electron or source-side injection techniques. The cited IEEE Press Brown and Brewer book portion clearly describes that voltages applied to the control gate and drain cause such programming. Neither of the claimed channel hot-electron injection nor source-side injection can result from use of the one voltage specified in the Reisinger patent. Although the memory of Reisinger could possibly be modified to program its cell with channel hot-electron injection or source-side injection by changing the voltage source during programming, such a changed voltage source is not described or suggested. Reisinger is clearly limited to programming circuits with voltage magnitudes that cause Fowler-Nordheim programming and do not cause programming by the claimed techniques.

It is respectfully submitted that a structure for a programming circuit source of voltages is clearly defined by the claims in a manner that distinguishes the cited Reisinger reference.

Telephone Examiner Interview Held on April 22, 2003

The telephone interview was initiated with Examiner Weiss by the undersigned attorney to discuss the basis for the above-described claim scope issue raised by the Office Action. A more general discussion of the issue than that given above was had during the Interview. In response to the Interview, the amendment of the four independent claims is being made, the amendment to claim 19 being discussed above as exemplary. The claims are being amended to more specifically recite the connections of the programming voltages and their magnitudes in functional terms. For the reasons

given above, it is believed that the amended independent claims 13, 19, 23 and 34 each define a structure that is novel over the cited Reisinger patent reference.

Response to the Obviousness Rejections under 35 U.S.C. §103(a)

The independent claims 13, 19, 23 and 34 are each rejected over a primary reference that lacks either use of dielectric storage elements or the storage of more than two defined threshold ranges, or both. Patent no. 6,011,752 ("Eitan") is the primary reference applied to claim 13, patent no. 5,278,439 ("Ma et al.") is applied to claims 19 and 23, and patent no. 6,346,725 ("Ma") to claim 34. In each case, the Reisinger patent is alleged to have made it obvious to modify the primary reference to meet the terms of the claims. Reconsideration of this basis for the rejections is respectfully requested.

Once the proper scope of the "programming circuit" and the "programming means" are established, as discussed above, the claims very clearly distinguish from the Reisinger patent. The dielectric of the Reisinger patent is programmed by Fowler-Nordheim tunneling. (Reisinger, col. 2, lns. 22-24, and col. 3, lns. 7-12 and 60-65). By this mechanism, electrons tunnel into the dielectric across the entire length of the channel region 4 of Reisinger since it is the electric field generated by the voltage difference between the substrate region 4 and gate electrode 6, both of which extend across the entire channel, that causes the tunneling. (See also section 1.2.1 of the cited IEEE Press Brown and Brewer book.)

Each of claims, on the other hand, specifies programming by either channel hot-electron injection or source-side injection, two of the other programming mechanisms described in the cited Brown and Brewer IEEE Press book. These mechanisms cause electrons to be injected onto the floating gate to either its side nearest to the drain (channel hot-electron injection) or to its side nearer to the source (source-side injection).

In the case of claim 13, the teaching of Reisinger did not, it is respectfully submitted, make it obvious to increase the number of storage states in each programmed area of the Eitan dielectric device. A combination of the two would have resulted in the Eitan system being operated with Fowler-Nordheim programming in accordance with Reisinger, which is excluded by the claims as amended. Further, since charge is stored

uniformly in the dielectric across a channel of a device programmed according to Reisinger, the two separate storage areas of Eitan would necessarily be lost. Such a combination of the Eitan and Reisinger references would have resulted in something much different than what is claimed. A memory cell would result that has a single storage site uniformly programmed to multiple levels across each cell, rather than at least two storage regions of the claims that are each programmable to more than two threshold levels, as claimed. The references themselves inherently teach away from such a combination. And certainly nothing has been found in these references that would have suggested any combination of their teachings, particularly one according to claim 13 and its dependent claims.

With respect to the remaining independent claims 19, 23 and 34, a combination of the Reisinger reference with either of the cited Ma et al. or Ma references would also have been contrary to the teachings of these references. Particularly since the memory cell charge storage elements of the cited Ma et al. and Ma patent references are conductive floating gates, charge injected onto a limited area of the floating gate is quickly redistributed across it. The resulting charge distribution is similar to that which results in Reisinger from Fowler-Nordheim programming into a dielectric storage element, where the charge does not migrate.

It is submitted, therefore, that it would not have been obvious to substitute dielectric charge storage elements for the floating gates of the Ma et al. or Ma references in the manner claimed. To do so would have required operation of the Ma et al. or Ma systems with Fowler-Nordheim programming in accordance with Reisinger, which is excluded by the claims as amended. The claims specify programming dielectric storage elements with charge in a localized region, as described in the present application (see Figures 9 and 12, for example). This is the result of either of the two programming mechanisms specified in the claims. Nothing has been noted in either of the Ma et al., Ma or Reisinger references that suggests changing the programming technique of Reisinger to that of Ma et al. or Ma in order to obtain such localized charge storage regions. To the contrary, is seems that the Fowler-Nordheim charge storage system of Reisinger would have been maintained in any such combination in order to provide a

charge distribution in the charge storing dielectric across the entire channel as exists with the conductive floating gates of the Ma et al. and Ma references.

This is particularly true when specifying multi-state storage, i.e. more than one bit stored in each of the charge storage regions. Since Ma et al. and Ma do not discuss multi-state storage but Reisinger does, the mechanism for multi-state storage in a dielectric would likely have been Reisinger's Fowler-Nordheim programming, which is outside the scope of these claims.

It is therefore submitted that the independent claims 13, 19, 23 and 34, and thus also their dependent claims, are patentable over the cited references.

Claim Objections and Claim Rejections Under 35 U.S.C. §112, 2nd Paragraph

Claim 28: The objection that claim 28 is improper for being dependent upon a multiple dependent claim is believed incorrect. 37 C.F.R. §1.75(c) prohibits a multiple dependent claim being dependent upon another multiple dependent claim, but claim 28 is not in multiple dependent form. Also, M.P.E.P. 608.01(n), August 2001, appears to expressly allow it. See the table on page 600-74, where claim 7 is dependent upon multiple dependent claim 6. However, although the present claim form is preferred, some parallel claims could be added in place of the multiple dependent claims if the Examiner still considers this form to be undesirable.

Claims 13 and 23: The "or" has been changed in claim 13 to "and" but not in claim 23. Claim 13 specifies one of the recited program mechanisms, so the "and" seems appropriate there. It is a concern that making the requested change to claim 23 would literally require programming by both of the recited mechanisms instead of the desired one or the other. Such a result is not intended.

Claim 26: The word "elements" is being deleted, which is believed to correct the claim.

Claim 13: Some voluntary amendments are being made to correct apparent lack of antecedent bases that were discovered when reviewing the claim.

New Claims

New claims 37 – 41 being added by this Amendment correspond respectively to claims 13 – 18 but use some different terminology. The new claims are submitted to be patentable for the same reasons discussed above with respect to claims 13 – 18.

Information Disclosure Statements filed October 21, 2002 and January 7, 2003

Nothing has been returned to the undersigned attorney to indicate that the references cited in these two Information Disclosure Statements have been considered by the Examiner and made of record in the file of the present application. Accordingly, copies of them are being filed herewith. If further copies of any of the listed references are needed, please notify the undersigned attorney and copies will be promptly supplied.
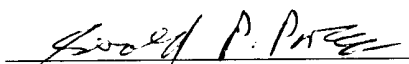
Conclusion

Accordingly, it is believed that this application is now in condition for allowance and an early indication of its allowance is solicited. However, if the Examiner has any further matters that need to be resolved, a telephone call to the undersigned attorney would be appreciated.

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Respectfully submitted,

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